

Appl. No.: 10/627,166  
Amdt. Dated 02/07/05  
Reply to Office Action of August 5, 2004

### **REMARKS/ARGUMENTS**

Applicant thanks the Examiner for a thorough review of the above-referenced application. As explained more fully below, Applicant has amended independent Claims 1, 18, 26, 34 and 41 to more clearly define the claimed invention. As a result of these amendments, dependent Claims 2, 19, and 28 have been cancelled. Applicant requests reconsideration of Claims 1-43 in view of the Amendments and Remarks set forth herein.

### **Invention**

In seeking to provide high-strength concrete mixtures that are lightweight and less expensive to manufacture and package in comparison to conventional concrete mixtures, others have proposed replacing all or a portion of the cement, sand, and/or coarse aggregates with other materials. For example, there has been considerable attention given to the use of by-products from pulverized coal combustion and refuse burning processes as a replacement for the cement, fine aggregate, and/or coarse aggregate in conventional concrete mixtures. Generally, by-products from pulverized coal combustion in thermal power stations can be categorized as fly ash, bottom ash, and slag. Fly ash comprises particles that are convected upwardly with the flue gases of a furnace and are separated therefrom using electrostatic precipitators and/or mechanical collectors. Fly ash generally includes fine particles having a relatively consistent particle size ranging from approximately .04 mil (1  $\mu$ m) to 7.8 mil (200  $\mu$ m). Bottom ash comprises heavier particles ranging in size from approximately 2 inches (5.08 cm) and less that fall to the bottom of the furnace where the particles are collected in either a dry form or in a water-filled ash pit. Slag comprises molten or partially fused particles that come into contact with the furnace wall, become chilled, and solidify. Slag is generally much denser than either fly ash or bottom ash. The use of these by-products is particularly attractive since these materials are considered to be waste products that would normally be landfilled, thus potentially providing an inexpensive and readily available lightweight aggregate and pozzolan to replace all or a portion of the cement, fine aggregate and/or coarse aggregate in conventional concrete mixtures. Unfortunately, these prior art compositions have provided seven-day compressive strengths and twenty-eight-day compressive strengths well below that provided by conventional concrete mixtures and/or have

Appl. No.: 10/627,166  
Amdt. Dated 02/07/05  
Reply to Office Action of August 5, 2004

required additional processing steps, such as grinding the bottom ash and mixing the ground bottom ash with other materials, which increases the overall cost of the composition.

It is believed that the inventor of the present invention is the first to have provided a high-strength cementitious composition for mixing with an effective amount of water to form a structural product, wherein the cementitious composition of the present invention advantageously is formed of a lightweight aggregate and pozzolan such that the composition weighs less per unit volume than conventional cementitious compositions yet has seven-day and twenty-eight-day compressive strengths approximating, or exceeding, those of conventional concrete mixtures not including by-products from pulverized coal combustion. According to one embodiment of the present invention, as recited in independent Claim 1, the composition consists essentially of an effective amount of bottom ash and an effective amount of cement wherein the structural product formed from mixing the composition with the effective amount of water has a seven-day compressive strength of at least about 2,500 psi or a twenty-eight-day compressive strength of at least about 4,000 psi. In another embodiment, as recited in independent Claim 9, the composition comprises an effective amount of bottom ash and an effective amount of cement, and wherein the composition has a per unit volume weight of less than about 100 pounds per cubic foot of volume and wherein the structural product formed from mixing the composition with the effective amount of water has a seven-day compressive strength of at least about 2,500 psi. In another embodiment of the present invention, as recited in independent Claim 18, the composition consists of an effective amount of bottom ash and an effective amount of cement wherein the structural product formed from mixing the composition with the effective amount of water has a seven-day compressive strength of at least about 2,500 psi or a twenty-eight-day compressive strength of at least about 4,000 psi.

The present invention also provides a cementitious product for mixing with an effective amount of water to form a structural product. According to one embodiment, as recited in independent Claim 26, the cementitious product comprises a container having a volume and a cementitious composition substantially filling the volume of the container. The cementitious composition comprising an effective amount of bottom ash and an effective amount of cement, and wherein the container and the composition together weigh less than approximately 100

Appl. No.: 10/627,166  
Amdt. Dated 02/07/05  
Reply to Office Action of August 5, 2004

pounds per cubic foot of volume and wherein the structural product formed from mixing the composition with the effective amount of water has a seven-day compressive strength of at least about 2,500 psi or a twenty-eight-day compressive strength of at least about 4,000 psi.

The present invention also provides a method of manufacturing a cementitious product. According to one embodiment, as recited in independent Claim 34, the method comprises providing a cementitious composition consisting essentially of an effective amount of bottom ash and an effective amount of cement. The cementitious composition is packaged in a container wherein the container and the composition together weigh less than approximately 100 pounds per cubic foot of volume. In another embodiment, as recited in independent Claim 41, the method comprises providing a cementitious composition consisting essentially of an effective amount of bottom ash and an effective amount of cement. The cementitious composition is mixed with an effective amount of water. Subsequent to the mixing step, the cementitious composition is cured to thereby form a structural product having a seven-day compressive strength of at least about 2,500 psi or a twenty-eight-day compressive strength of at least about 4,000 psi.

#### **The Rejection Under 35 U.S.C. § 112 Should Be Withdrawn**

The Office Action rejected Claims 1-43 under 35 U.S.C. § 112, second paragraph, asserting that the terms "effective amount" for bottom ash and cement are indefinite. Applicant respectfully disagrees. As explained in MPEP 3173.05(c)(III), the phrase "an effective amount" has been held to be definite where the disclosure provides "guidelines as to the intended utilities and how the uses could be achieved." In the present application, Applicant submits that the disclosure provides such guidelines as to the intended utilities and how the uses can be achieved. For example, the disclosure provides guidelines for the intended utilities at Page 14, ll. 1-12, including forming high strength structural products, grout, etc. The disclosure also provides guidelines for how the uses can be achieved, including selecting the cement (Page 9, ll. 24-29), sizing the bottom ash (Page 10, line 20 – Page 12, line 2, and in Figure 3), mixing the cement and bottom ash (Page 12, ll. 3-28). Accordingly, Applicant respectfully submits that the phrase "an effective amount" in Claims 1-43 is definite and that the rejection under 35 U.S.C. § 112,

Appl. No.: 10/627,166  
Amdt. Dated 02/07/05  
Reply to Office Action of August 5, 2004

second paragraph, should be withdrawn.

Appl. No.: 10/627,166  
Amdt. Dated 02/07/05  
Reply to Office Action of August 5, 2004

**The Rejections Under § 102 and § 103 Directed to Claims 1-43 Are Overcome**

The Office Action rejected Claims 1-43 under 35 U.S.C. § 102 (a) and (b) as anticipated by or, in the alternative, under 35 U.S.C. § 103 as obvious over U.S. Patent No. 5,849,075 to Hopkins et al., U.S. Patent No. 5,772,751 to Nisnevich et al., U.S. Patent No. 6,528,547 B2 to Shulman, U.S. Patent No. 6,030,446 to Doty et al., U.S. Patent No. 4,050,950 to Brewer et al., U.S. Patent No. 4,050,261 to Brewer et al., Japanese Patent No. 61021940 to Hironaka et al., DD 157092 to Kornemann et al., Berg et al. (Journal of Materials in Civil Engineering (1998)), Ghafoori et al. (Journal of Materials in Civil Engineering (1996)), Lai et al., or WO 8600290 to Eun et al. Applicant respectfully submits that the cited references do not teach or suggest, either singly or in combination, the invention as claimed in independent Claims 1, 9, 18, 26, 34, and 41.

The Hopkins '075 patent discloses a cementitious composition comprising Portland cement in association with a pozzolanic material that includes ground bottom ash. The bottom ash is ground to a particle size in which 80 to 100% and, preferably, 85 to 90% pass a 45 µm screen so that the resulting bottom ash is a highly active pozzolan. As noted in Example 1 of the Hopkins '075 patent (Cols. 3 and 4), this results in the bottom ash having the same fineness as fly ash. Hopkins further discloses that the pozzolanic material preferably comprises an admixture of bottom ash and silica fume (Col. 2, ll. 63-67), since "the use of only ground bottom ash with the Portland cement results in a drop in compressive strength...." (See Col. 5, Example 2). Hopkins also discloses mixing the cementitious composition with a mineral aggregate, such as a coarse aggregate having a particle size of approximately 5 to 20 mm and/or a fine aggregate like sand.

The Nisnevich '751 patent discloses a concrete comprising cement, bottom ash and an additive that is preferably fly ash. As disclosed in Nisnevich (see the Example at Col. 15, ll. 10-27), the use of only cement and bottom ash resulted in a twenty-eight day compressive strength of 4.9 MPa (710 psi).

The Shulman '547 patent discloses a synthetic aggregate and method of producing the same. According to Shulman, the synthetic aggregate is made by curing and then crushing a compressed product made from an aqueous cementitious mixture comprising cement, bottom

Appl. No.: 10/627,166  
Amtd. Dated 02/07/05  
Reply to Office Action of August 5, 2004

ash, fly ash and other adjuvants and fillers, including polystyrene foam particles, water proofer, plasticizer, crushed glass. (See Examples 1-28, Cols. 8-15.)

The Doty '446 patent discloses a cementitious composition comprising Portland cement, coal combustion byproducts (such as fly ash, stack dust, and bottom ash) and extruded polystyrene. (Col. 3, ll. 18-55).

The Brewer '261 and '950 patents disclose a method of backfilling and a controlled density fill material containing fly ash, respectively. As disclosed in both the Brewer '261 and '950 patents, the fill material comprises Portland cement, fly ash, aggregate (berm aggregates and Maumee Estuary sand). (See Col. 2, ll. 31-37 and Col. 3, ll. 34-44 of both the '261 and '950 patents).

The Hironaka '940 Japanese patent, Kornemann '092 patent, Berg article, and Lai article all disclose a mixture of cement, fly ash, and bottom ash.

The Gahfoori article discloses combining Portland cement, bottom ash, crushed limestone and coarse aggregate.

The Eun '290 application discloses combining Portland cement, blast-furnace slag, gypsum and bottom ash.

Thus, the Hopkins '075, Shulman '547, Doty '446 patents, the Hironaka '940 Japanese patent, the Kornemann '092 patent, Eun '290 application, Berg article, Gahfoori article, and Lai article, each disclose combining cement, bottom ash and other materials, such as silica fumes, fly ash, expanded Polystyrene, blast-furnace slag and other adjuvants and fillers, which increases the per unit volume weight of the mixture and the cost for packaging the mixture. The Brewer '261 and Brewer '950 patents disclose combining cement, fly ash and aggregate (berm aggregates and Maumee Estuary sand). In contrast, independent Claim 1 recites a composition consisting essentially of bottom ash and cement and, independent Claim 18 recites a composition consisting of bottom ash and cement. In addition, the Hopkins '075 patent and Nisnevich '751 patent both teach that combining cement and bottom ash alone decreases the compressive strength of the resulting cementitious composition, and, thus, when the above references are considered in view of Hopkins and Nisnevich, it is clear that these references teach away from a cementitious composition consisting essentially of, or consisting of, bottom ash and cement and

Appl. No.: 10/627,166  
Amdt. Dated 02/07/05  
Reply to Office Action of August 5, 2004

wherein the structural product formed from mixing the composition with the effective amount of water has at least one of a seven-day compressive strength of at least about 2,500 psi and a twenty-eight-day compressive strength of at least about 4,000 psi, as recited in independent Claims 1, and 18, respectively.

Similarly, none of the cited references, either alone or in combination, teaches or suggests a cementitious composition comprising bottom ash and cement wherein the composition has a per unit volume weight of less than about 100 pounds per cubic foot of volume and wherein the structural product formed from mixing the composition with the effective amount of water has a seven-day compressive strength of at least about 2,500 psi, as recited in independent Claim 9, or a cementitious product comprising a container having a volume and a cementitious composition substantially filling the volume of the container, the cementitious composition comprising an effective amount of bottom ash and an effective amount of cement, and wherein the container and the composition together weigh less than approximately 100 pounds per cubic foot of volume and wherein the structural product formed from mixing the composition with the effective amount of water has a seven-day compressive strength of at least about 2,500 psi or a twenty-eight-day compressive strength of at least about 4,000 psi. As noted above, the Hopkins '075, Shulman '547, Doty '446 patents, the Hironaka '940 Japanese patent, the Kornemann '092 patent, Eun '290 application, Berg article, Gahfoori article, and Lai article, each disclose combining cement, bottom ash and other materials, which increases the per unit volume weight of the mixture, and the Hopkins '075 patent and Nisnevich '751 patent both teach that combining cement and bottom ash alone decreases the compressive strength of the resulting cementitious composition. Thus, the combination of light weight and high strength provided by the present invention is not taught or suggested by the cited references, either alone or in combination.

Likewise, none of the cited references, either alone or in combination, teaches or suggests a method of manufacturing a cementitious product that comprises providing a cementitious composition consisting essentially of an effective amount of bottom ash and an effective amount of cement and then packaging the composition in a container wherein the container and the composition together weigh less than approximately 100 pounds per cubic foot of volume, as recited in independent Claim 34, or a method of making a structural assembly comprising

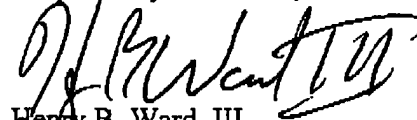
Appl. No.: 10/627,166  
Amtdt. Dated 02/07/05  
Reply to Office Action of August 5, 2004

providing a cementitious composition consisting essentially of an effective amount of bottom ash and an effective amount of cement, mixing the composition with an effective amount of water, and, subsequent to the mixing step, curing the composition to thereby form a structural product having a seven-day compressive strength of at least about 2,500 psi or a twenty-eight-day compressive strength of at least about 4,000 psi, as recited in independent Claim 41.

Accordingly, it is respectfully submitted that independent Claims 1, 9, 18, 26, 34, and 41, and the claims depending therefrom, include recitations that patentably distinguish the claimed invention over the cited references and that the rejections directed to these claims be withdrawn.

It is not believed that extensions of time or fees for net addition of claims are required, beyond those that may otherwise be provided for in documents accompanying this paper. However, in the event that additional extensions of time are necessary to allow consideration of this paper, such extensions are hereby petitioned under 37 CFR § 1.136(a), and any fee required therefore (including fees for net addition of claims) is hereby authorized to be charged to Deposit Account No. 16-0605.

Respectfully submitted,

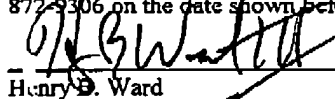


Henry B. Ward, III  
Registration No. 42,212

Customer No. 00826  
ALSTON & BIRD LLP  
Bank of America Plaza  
101 South Tryon Street, Suite 4000  
Charlotte, NC 28280-4000  
Tel Charlotte Office (704) 444-1000  
Fax Charlotte Office (704) 444-1111

CERTIFICATION OF FACSIMILE TRANSMISSION

I hereby certify that this paper is being facsimile transmitted to the US Patent and Trademark Office at Fax No. (703) 872-9306 on the date shown below.

  
Henry B. Ward

February 7, 2005

Date